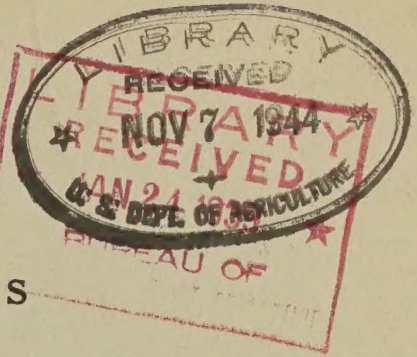


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THE INTRODUCTION AND COLONIZATION IN PUERTO RICO
OF DASYSCAPUS PARVIPENNIS GAHAN, A PARASITE OF THRIPS

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THE RED-BANDED THRIPS IS COMMON IN PUERTO RICO.

THE RED-BANDED THRIPS, SELENOTHRIPS RUBROCINCTUS GIARD, IS A MINUTE INSECT USUALLY FOUND FEEDING ON THE UNDERSIDE OF THE LEAVES OF VARIOUS PLANTS, IN PUERTO RICO IT IS A PEST OF THE MANGO, MANGIFERA INDICA. IT IS ALSO COMMON ON WILD OR TROPICAL ALMOND, TERMINALIA CATAPPA; CACAO, THEOBROMA CACAO; AVOCADO, PERSEA AMERICANA; GUAVA, PSIDIUM GUAJAVA; CASHEW, ANACARDIUM OCCIDENTALE; JOBO, SPONDIAS MOMBIN; AND OTHER HOSTS. WHEREVER THE CACAO INDUSTRY IS OF IMPORTANCE IN THE LESSER ANTILLES THIS PEST IS A LIMITING FACTOR IN PRODUCTION, AND CONSIDERABLE TIME AND MONEY HAVE BEEN SPENT TO STUDY METHODS OF THE CONTROL ON THIS CROP.

THE ADULT THRIPS IS A SMALL BLACK INSECT. IT DERIVES ITS NAME FROM THE NYMPHS, OR YOUNG, WHICH ARE SMALLER THAN THE ADULT, BUT YELLOW IN COLOR WITH A DISTINCT RED BAND ABOUT THE ABDOMEN. BOTH THE NYMPHS AND ADULTS RASP THE SURFACE OF THE PARTS OF THE PLANTS ATTACKED AND FEED ON THE JUICES THUS LIBERATED. AS A RESULT OF THIS FEEDING THE SURFACE CELLS DIE AND BECOME BROWN IN COLOR. THE YOUNG NYMPHS ALSO EXCRETE FROM THE TIP OF THE ABDOMEN A BALL OF BROWN SEMI-LIQUID MATERIAL WHICH THEY CARRY ABOUT AND LATER DEPOSIT ON THE LEAF. THESE DEPOSITS GIVE THE LEAF A DIRTY, FLY-SPECKED APPEARANCE.

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PUPAE OF THE PARASITE DASYSKAPUS PARVIPENNIS WERE RECEIVED FROM TRINIDAD.

A SHIPMENT OF 1,556 PUPAE OF DASYSKAPUS PARVIPENNIS GAHAN WAS SENT TO PUERTO RICO BY S.M. DOHANIAN OF THE BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE FROM TRINIDAD IN MARCH 1936. THE ORIGINAL STOCK, FROM WHICH THESE PUPAE WERE REARED BY MR. DOHANIAN, WAS OBTAINED THROUGH THE DIRECTOR OF AGRICULTURE FOR TRINIDAD AND TOBAGO AND THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE OF ST. AUGUSTINE, TRINIDAD. THIS PARASITE HAD BEEN IMPORTED INTO TRINIDAD FROM ACCRA, GOLD COAST, AFRICA. ON THE GOLD COAST IT HAS BEEN REPORTED TO KILL AS MANY AS 80 PERCENT OF ITS HOST POPULATION, WHICH IT THUS APPARENTLY KEEPS UNDER ECONOMIC CONTROL.

OTHER THRIPS PESTS ARE HOSTS FOR DASYSKAPUS PARVIPENNIS.

WHILE DASYSKAPUS PARVIPENNIS WAS IMPORTED INTO TRINIDAD PRIMARILY TO AID IN THE CONTROL OF SELENOTHRIPS RUBROCINCTUS, IT SHOULD BE NOTED THAT THIS PARASITE WAS ORIGINALLY DESCRIBED FROM JAVA AS A PARASITE OF THE ONION THRIPS, THRIPS TABACI LIND. IN TRINIDAD IT HAS BEEN REARED ON THIS AND TWO OTHER SPECIES OF THRIPS, AND IN THE UNITED STATES IT HAS BEEN REARED ON THE COMMON GREENHOUSE THRIPS, HELIOTHRIPS HAEMORRHOIDALIS BOUCHE. UNDER LABORATORY CONDITIONS IN PUERTO RICO THE PARASITE HAS BEEN REARED ON THE ONION THRIPS.

RED-BANDED THRIPS ON TROPICAL ALMOND LEAVES WERE USED TO REAR THE PARASITE IN THE LABORATORY.

OF THE ORIGINAL 1,556 PUPAE RECEIVED FROM TRINIDAD 1,079 WERE LIBERATED IN THE FIELD, THE REMAINING 477 PUPAE, FROM WHICH 314 ADULTS EMERGED, BEING RETAINED AND USED AS A BREEDING STOCK FROM WHICH TO INCREASE THE NUMBERS AVAILABLE FOR FURTHER LIBERATION. IN GENERAL THE REARING TECHNIQUE FOLLOWED IN BREEDING DASYSKAPUS WAS THAT USED IN TRINIDAD, ALTHOUGH A FEW CHANGES WERE MADE. THE SUBSTITUTION OF TROPICAL ALMOND LEAVES FOR CASHEW WAS NECESSITATED BY LOCAL CONDITIONS. THE TROPICAL ALMOND IS ABUNDANT IN PUERTO RICO; WHILE MANY TREES ARE APPARENTLY IMMUNE TO ATTACK, OTHERS APPEAR TO BE CHRONICALLY INFESTED AND THUS OFFER A READILY AVAILABLE AND ABUNDANT SUPPLY OF HOST MATERIAL FOR REARING THE PARASITE.

THE CAGES USED FOR THE BREEDING OF THIS PARASITE WERE CONSTRUCTED OF CELLULOID ROLLED INTO A CYLINDER 10 INCHES IN LENGTH AND 6 INCHES IN DIAMETER. AT EACH END OF THE CYLINDER A WOODEN EMBROIDERY HOOP WAS PLACED FOR SUPPORT, AND THE ENDS WERE COVERED WITH MUSLIN CLOTH HELD IN PLACE BY MEANS OF RUBBER BANDS. THE ADULT PARASITES WERE FED ON CUT RAISINS PLACED WITHIN THE CYLINDER. THE USUAL NUMBER OF PARASITES PLACED IN EACH CYLINDER WAS FIVE FEMALES AND FIVE MALES. THE PARASITE ADULTS ARE SHORT LIVED, AVERAGING ONLY 5 DAYS, THE LONGEST PERIOD OF LIFE OBSERVED BEING 9 DAYS.

THE METHOD USED TO REAR THIS PARASITE IN TRINIDAD WAS TO EXPOSE THE THRIPS-INFESTED LEAVES TO THE PARASITES FOR A PERIOD OF 24 HOURS, AND THEN REMOVE THE LEAVES AND PLACE THEM IN ANOTHER CONTAINER WHILE FRESHLY

INFESTED MATERIAL WAS AGAIN EXPOSED. FOR THE REARING WORK IN PUERTO RICO A RADICAL CHANGE WAS MADE IN THIS RESPECT. THE METHOD ADOPTED AFTER MUCH EXPERIMENTATION WAS TO PLACE FOUR INFESTED ALMOND LEAVES IN EACH CAGE; FOUR INFESTED LEAVES WERE ADDED ON THE SECOND DAY AND FOUR MORE ON THE FOURTH DAY. FRESH UNINFESTED LEAVES WERE ADDED AS NECESSARY AFTER THE FOURTH DAY IN ORDER TO INSURE AN ADEQUATE FOOD SUPPLY FOR THE HOST INSECTS UNTIL THE MAXIMUM AMOUNT OF PARASITIZATION WAS ASSURED. THE OLD FOLIAGE WAS ALLOWED TO REMAIN IN THE CYLINDER DURING THE ENTIRE PERIOD.

THE LIFE CYCLE OF THE PARASITE COVERS ABOUT 20 DAYS.

THE LIFE CYCLE, FROM EGG TO ADULT, OF DASYSCAPUS PARVIPENNIS WAS COMPLETED IN ABOUT 20 DAYS; THE PUPAL STAGE WAS REACHED IN ABOUT 10 DAYS. THEREFORE, IN THE REARING TECHNIQUE, THE PUPAE WERE REMOVED FROM THE LEAVES ON THE TWELFTH TO FIFTEENTH DAY AFTER THE THRIPS WERE EXPOSED TO THE PARASITES. EMERGENCE TOOK PLACE AS EARLY AS THE EIGHTEENTH DAY AND CONTINUED OVER A PERIOD OF 7 TO 10 DAYS.

THE ADULT PARASITE IS A SMALL BLACK AND YELLOW WASP-LIKE INSECT ABOUT 0.5 MM IN LENGTH. THE FIRST ANTENNAL JOINT OF THE MALES IS GREATLY ENLARGED AND IS CHARACTERISTIC OF THE SEX. MATING TAKES PLACE READILY SHORTLY AFTER EMERGENCE. THE FEMALE PARASITE PLACES AN EGG WITHIN THE BODY OF THE YOUNG THRIPS WHERE THE PARASITE LARVA DEVELOPS FOR A PERIOD OF ABOUT 8 DAYS. AT THIS TIME THE CHARACTERISTIC RED BAND OF THE NYMPH DISAPPEARS, AND THE PARASITE LARVA MAY BE OBSERVED WITHIN THE BODY OF THE HOST WHEN PLACED UNDER SLIGHT MAGNIFICATION. AT THE END OF ABOUT 2 DAYS MORE, OR A TOTAL OF 10 DAYS, THE THRIPS TURNS PINK IN COLOR AND THE PARASITE LARVA SPLITS OPEN WHAT IS NOW ONLY THE SKIN OF ITS HOST AND CHANGES INTO THE PUPAL STAGE. THE PUPAE ARE BLACK IN COLOR AND REMAIN ATTACHED TO THE CAST NYMPHAL SKIN OF THE HOST WHICH USUALLY ADHERES TO THE LEAF.

THE PUPAE THAT WERE TO BE USED FOR BREEDING WORK WERE REMOVED FROM THE LEAVES BY MEANS OF A CAMEL'S-HAIR BRUSH AND PLACED ON MOIST PAPER AND HELD IN GLASS TUBES FOR EMERGENCE. THE PUPAE WERE HELD IN A MOIST ATMOSPHERE AND THE PAPER WAS MOISTENED DAILY. THE PUPAE INTENDED FOR LIBERATION WERE ALLOWED TO REMAIN ON THE LEAVES HELD UNDER MOIST CONDITIONS UNTIL JUST PRIOR TO ADULT EMERGENCE.

THE AVERAGE PERCENTAGE OF ADULT EMERGENCE WAS DETERMINED IN ONLY A FEW CASES, BUT IN THESE IT VARIED BETWEEN 83 AND 87 PERCENT.

PARASITES PREFER YOUNG THRIPS FOR PARASITIZATION.

VERY YOUNG THRIPS ARE PREFERRED AS HOSTS BY THE PARASITES, AND A MUCH HIGHER PERCENTAGE OF PARASITISM WAS OBTAINED WHEN SUCH MATERIAL WAS AVAILABLE. THE PERCENTAGE OF PARASITISM IN NEWLY HATCHED THRIPS WAS NEARLY DOUBLE THAT IN FULLY DEVELOPED ONES IN AN EXPERIMENT CONDUCTED TO COMPARE THE USE OF THE TWO TYPES OF NYMPHS.

THE NUMBER OF THRIPS PLACED IN EACH CYLINDER VARIED AND WAS DEPENDENT UPON THE HOST MATERIAL AVAILABLE. AS PREVIOUSLY STATED, A TOTAL

OF TWELVE LEAVES WAS PLACED IN EACH CYLINDER ON DIFFERENT DAYS, AND EFFORTS WERE MADE SO FAR AS POSSIBLE TO USE LEAVES THAT WERE UNIFORMLY INFESTED. IN SPITE OF THIS, HOWEVER, THERE WAS CONSIDERABLE FLUCTUATION IN THE HOST POPULATION ON THE LEAVES FROM GENERATION TO GENERATION. ALTHOUGH NO ATTEMPT WAS EVER MADE TO ASCERTAIN THE ACTUAL NUMBER OF HOST THRIPS PRESENT, THE TYPE AND NUMBER USED REFLECTED THE PERCENTAGE OF INCREASE.

THIRTY-THREE GENERATIONS OF THE PARASITE WERE REARED IN THE LABORATORY.

SINCE THE INTRODUCTION OF DASYSCAPUS PARVIPENNIS IN MARCH 1936 UNTIL JUNE 1, 1938, THIRTY-THREE GENERATIONS OF THE PARASITE HAVE BEEN REARED IN THE LABORATORY. THE NUMBER OF PUPAE REARED WAS 88,315.

THE HIGHEST INCREASE OBTAINED IN ANY SINGLE GENERATION WAS 2,420 PERCENT, AND THE HIGHEST INCREASE RECORDED FOR ANY SINGLE CAGE WAS 5,320 PERCENT. THESE RATES OF INCREASE ARE BASED ON THE NUMBER OF PARASITE PUPARIA RECOVERED, OVER THE NUMBER OF FEMALE PARASITES USED.

THRIPS PARASITE WAS LIBERATED IN VARIOUS LOCALITIES ON THE ISLAND.

LIBERATIONS OF DASYSCAPUS PARVIPENNIS WERE MADE IN MANY SECTIONS OF THE ISLAND. IN GENERAL THE PROCEDURE WAS TO LIBERATE PUPAE, BUT AS THE PUPAE ARE USUALLY RETAINED IN THE LABORATORY UNTIL JUST PRIOR TO EMERGENCE, DIRECT LIBERATION OF A FEW ADULTS OFTEN RESULTED. IN ORDER TO SIMPLIFY THE RECORDS, HOWEVER, ALL LIBERATIONS WERE RECORDED ON THE BASIS OF THE NUMBER OF PUPAE ONLY.

TWO METHODS WERE USED IN THE LIBERATION OF THIS PARASITE. IN ONE, THE PUPAE WERE FIRST REMOVED TO PIECES OF PAPER WHICH WERE THEN PLACED SECURELY ON FLAT SURFACES HAVING SINGLE LEG SUPPORTS ATTACHED TO AN INFESTED TREE OR THRUST INTO THE GROUND. THE SUPPORTS WERE WELL COATED WITH TANGLE-FOOT TO PREVENT ANTS, SPIDERS, OR ANY OTHER PREDACIOUS ENEMIES FROM ATTACKING THE PUPAE. IN THE SECOND METHOD THE PUPAE WERE NOT COLLECTED ON PAPERS BUT LEFT ON THE LEAVES ON WHICH THEY WERE REARED. THESE LEAVES WERE THEN TAKEN TO THE POINT OF LIBERATION AND PLACED IN WIRE CYLINDERS THAT WERE SUPPORTED BY TWO STAKES OR HUNG BY A CORD ATTACHED TO EACH END, WITH TANGLEFOOT PROTECTION.

TABLE 1, ON PAGE 5, IS A SUMMARY OF THE LIBERATIONS OF 56,401 PUPARIA OF DASYSCAPUS PARVIPENNIS.

THE LIBERATIONS AT MAYAGÜEZ WERE MADE ON THE GROUNDS OF THE EXPERIMENT STATION IN THE VICINITY OF A BED OF YOUNG MANGO SEEDLINGS INFESTED WITH SELENOTHRIPS RUBROCINCTUS; THOSE ON LAS MESAS WERE MADE IN THE VICINITY OF AN ONION PATCH HEAVILY INFESTED WITH THRIPS TABACI. THE LIBERATION POINT AT LAS MESAS ALSO AFFORDED OPPORTUNITY FOR THE PARASITIZATION OF A NUMBER OF OTHER SPECIES OF THRIPS ON OTHER PLANTS. THE LIBERATIONS IN SAN JUAN, YAUCO, CABO ROJO, AND SAN GERMÁN WERE MADE IN THE VICINITY OF TROPICAL ALMONDS HEAVILY INFESTED WITH S. RUBROCINCTUS.

TABLE 1. - LIBERATIONS OF DASYSCAPUS PARVIPENNIS IN PUERTO RICO
INCLUDING LOCATION, DATES, AND NUMBERS LIBERATED

DATE	LOCATIONS							TOTAL
	MAYAGÜEZ		SAN JUAN		YAUCO	CABO ROJO	SAN GERMÁN	
	EXPERIMENT STATION	LAS MESAS	CONDADO SECTION	MIRAMAR SECTION	ROAD 2, KM 231	ROAD 9, KM 2.3	ROAD 2, KM 198.1	
	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER
MAR. 5 TO MAY 25, 1936	2,089	....	....	....	....	....	....	2,089
JUNE 29 TO AUG. 21, 1936	....	....	....	....	2,775	....	....	2,775
SEPT. 14, 1936	....	....	2,500	2,500	....	....	....	5,000
SEPT. 18, 1936 TO NOV. 6, 1937	....	27,899	....	....	....	....	....	27,899
DEC. 24, 1936 TO FEB. 8, 1938	14,919	....	....	....	....	....	....	14,919
NOV. 26 TO JAN. 12, 1938	....	....	....	....	....	2,252	....	2,252
MAY 2 TO 25, 1938	....	....	....	....	....	....	1,467	1,467
TOTAL	17,008	27,899	2,500	2,500	2,775	2,252	1,467	56,401

TWO SHIPMENTS OF THE THRIPS PARASITE WERE MADE TO CONTINENTAL UNITED STATES.

TWO EXPERIMENTAL SHIPMENTS OF DASYSCAPUS PARVIPENNIS WERE MADE TO THE CONTINENTAL UNITED STATES DURING 1936. A SHIPMENT OF 7,000 PUPAE WAS MADE BY AIR EXPRESS ON SEPTEMBER 30 FOR LIBERATION IN GREENHOUSES AT BELTSVILLE, MARYLAND. A SECOND SHIPMENT OF 1,000 PUPAE, ALSO MADE BY AIR ON DECEMBER 11, WAS USED FOR EXPERIMENTAL BREEDING WORK BY F. F. SMITH OF THE BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE AT BELTSVILLE, MARYLAND.

DR. SMITH WAS SUCCESSFUL IN OBTAINING OVIPOSITION IN THE GREENHOUSE THRIPS, HELIOTHRIPS HAEMORRHODALIS, BUT HE EXPRESSED THE OPINION THAT THIS PARASITE WOULD NOT BE OF VALUE IN THE CONTROL OF THRIPS ATTACKING SUCH TEMPERATE-CLIMATE CROPS AS CHRYSANTHEMUMS, WHICH DURING THE WINTER ARE CARRIED AT TEMPERATURES OF 50° OR 55° F., AND HE BELIEVED THAT IT WOULD NOT DO WELL EVEN AT 65° F., WHICH IS MAINTAINED

FOR WARM-TEMPERATURE CROPS. APPARENTLY HIGHER TEMPERATURES, SUCH AS PREVAIL IN THE TROPICS, ARE NECESSARY FOR THE DEVELOPMENT OF THIS PARASITE.

INITIAL RECOVERIES OF PARASITE WERE MADE BUT THE PARASITE WAS NOT ABLE TO MAINTAIN ITSELF.

SHORTLY AFTER THE ORIGINAL LIBERATIONS WERE MADE AT MAYAGÜEZ IN MARCH 1936, THERE WERE RECOVERED A NUMBER OF SPECIMENS OF DASYSCAPUS PARVIPENNIS IN THE IMMEDIATE VICINITY OF THE LIBERATION POINT. FURTHER RECOVERIES OF THE PARASITE IN THE FIELD WERE LIMITED TO SIMILAR FINDINGS WITHIN ONE GENERATION AFTER RELEASE IN THE VICINITY OF THE LIBERATION POINTS. AFTER LIBERATIONS WERE DISCONTINUED IT WAS NOT POSSIBLE TO FIND FURTHER EVIDENCE OF THE PARASITE. SINCE RECOVERIES HAVE BEEN THUS LIMITED TO THE FIRST GENERATION AFTER RELEASE EVEN AFTER EXTENSIVE AND VOLUMINOUS LIBERATIONS, IT IS FELT THAT THIS PARASITE IS NOT ABLE TO MAINTAIN ITSELF SUFFICIENTLY UNDER EXISTING CONDITIONS TO BE OF ANY ECONOMIC BENEFIT IN THE CONTROL OF THRIPS IN PUERTO RICO.

